APPENDIX A

RECORD OF DECISION

for the

Southern Plume
Operable Unit 2

Railroad Avenue Groundwater Contamination Site
West Des Moines, Iowa

Prepared by:

U.S. Environmental Protection Agency
Region VII

Kansas City, Kansas

September 2006

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Record of Decision
Declaration

SITE NAME AND LOCATION

Southern Plume – Operable Unit 2
Railroad Avenue Groundwater Contamination Site
West Des Moines, Iowa
CERCLIS ID No. IA0001610963

The Railroad Avenue Groundwater Contamination Site (Site) is located in West Des Moines, Iowa, a suburb of Des Moines, Iowa, in southwest Polk County in south central Iowa. Two separate source areas and their respective contaminant plumes have been identified at the Site. Because there are two separate and distinct plumes, the Site has been separated into two operable units (OU): OU1 – Northern Plume, and OU2 – Southern Plume. This Record of Decision (ROD) addresses the Southern Plume (OU2) of the Site.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for OU2 of the Site. The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The state of Iowa concurs with the selected remedy.

ASSESSMENT OF THE SITE

The remedial action selected in this ROD is necessary to protect the public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF SELECTED REMEDY

This ROD addresses groundwater contaminants of the Southern Plume. Two interim response actions have been initiated for the Southern Plume. The first action, which included expansion of treatment capacity with two new aerators at the West Des Moines Water Works (WDMWW) water treatment plant, addressed the well field area for both the Southern and Northern Plumes. The aerators have been in operation since November 2004. In December 2005 a system to perform focused air sparging was constructed to reduce the groundwater contamination that is suspected to be the source area of contamination for OU2. This decision document addresses residual groundwater contamination within OU2 that will not be addressed by either of the two interim response actions.

The principal risks at this site are associated with chlorinated volatile organic compounds (VOC) contamination in groundwater. Groundwater in the Southern Plume area of the site is contaminated primarily with trichloroethene (TCE). TCE was used as a degreasing solvent by the Potentially Responsible Party (PRP). An underground used-solvent storage tank used by the PRP and removed approximately 20 years ago is the suspected source of the OU2 contamination. Tetrachloroethene (PCE), cis-1,2 dichloroethene (cDCE), and trans-1,2dichloroethene (tDCE) have also been detected in Southern Plume groundwater. The PCE is attributed to impurities in the original TCE. The contaminants cDCE and tDCE are breakdown products of TCE, demonstrating that concentrations of VOC contaminants in OU2 appear to be diminishing through natural attenuation processes. Contaminants PCE, TCE, cDCE, and tDCE have been identified as the contaminants of concern (COCs) for OU2.

The selected remedy will permanently and significantly reduce the toxicity, mobility, and volume of the site COCs through the interim response actions along with natural attenuation processes as the principal element of remediation. The major components of the selected remedy for groundwater include the following:

- Continued operation of the aerators at the WDMWW treatment plant to treat water that reached the public water supply,
- Continued operation of the air-sparging system to meet remediation goals in the suspected source area,
- Restoration of the aquifer by reduction of the COCs through natural attenuation processes,
- Institutional controls including local or state well restrictions and public education to prevent use of contaminated groundwater.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for remedies that employ treatment as a principal element (i.e., this remedy reduces the toxicity, mobility, or volume of contaminants through treatment). Because hazardous substances above health-based levels are expected to be on-site in five years, a review will be conducted within five years after completion of the remedial action to ensure the remedy continues to provide adequate protection of human health and the environment.

DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary Section of the ROD:

- COCs and their respective concentrations,
- Baseline risk represented by the COCs,

- Cleanup levels established for COCs and the basis for the levels,
- How source materials constituting principal threats are addressed,
- Current and future land-use assumptions from the baseline risk assessment,
- Groundwater use that will be available at the site as a result of the selected remedy,
- Estimated capital, operation and maintenance (O&M), and total present-worth costs; discount rate; and the number of years over which the remedy cost estimates are projected,
- Decisive factors that led to selecting the remedy.

Additional information can be found in the Administrative Record for this site.

Authorizing Signature

Cecilia Tapia, Director
Superfund Division

9/11/06
Date

RECORD OF DECISION

Decision Summary

Southern Plume - Operable Unit 2
Railroad Avenue Groundwater Contamination Site
West Des Moines, Iowa

Prepared by:
U. S. Environmental Protection Agency
Region VII
Kansas City, Kansas

September 2006

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1.0 Site Name, Location, and Description

The Railroad Avenue Groundwater Contamination Site (Site) is located in West Des Moines, Iowa, which is a suburb of Des Moines, Iowa, in southwest Polk County in south central Iowa (Comprehensive Environmental Response, Compensation, and Liability Information System identification number IA0001610963). The U.S. Environmental Protection Agency (EPA) developed this Record of Decision (ROD) with support from the Iowa Department of Natural Resources (IDNR). Investigation of the Southern Plume was performed by the potentially responsible party (PRP) with the IDNR as the lead agency. Remediation of the Southern Plume will be performed by the PRP with EPA as the lead agency and IDNR as the support agency.

The Site consists of the West Des Moines Water Works (WDMWW) water treatment plant well field, the areas of groundwater contamination, and the potential source areas of the contamination (Figure 1). The Site is approximately 1,000 acres in size. The WDMWW well field contains 25 water supply wells (prefaced with the "WDMW" label) that historically and/or currently supplies water to the WDMWW water treatment plant. Most wells are used only periodically depending on seasonal water demand. Five municipal wells were taken off-line as a result of the chlorinated volatile organic compound (VOC) contamination: WDMW-6, -7, -12, -13, and -21. The first interim response action resulted in WDMW-6, -12, -13, and -21 being returned to service.

Two separate and distinct source areas and respective contaminant plumes have been identified through the EPA Expanded Site Inspection (ESI) and remedial investigation (RI) sampling efforts. Because there are two distinct plumes, the Site has been separated into two operable units (OU): OU1 – Northern Plume; and OU2 – Southern Plume.

The EPA is the lead agency for OU1. OU1 is generally located along either side of Railroad Avenue from 1st Street to 14th Street, impacting city wells WDMW-12 and -13. The final remedial actions at OU1 have been prescribed in two previously issued RODs. Several suspected source areas for OU1 were investigated during the ESI. The ESI included collecting and analyzing sediment, surface water, groundwater, surface soil, and subsurface soil samples from targeted industrial business properties and surrounding areas. Despite extensive efforts, no responsible party has been identified for OU1.

OU2 is generally located between South 19th Street and Grand Avenue and between Fuller Road and wells WDMW-19, -20, and -21 located in Raccoon River Regional Park (see Figure 2). Land use in the vicinity of OU2 is primarily light industrial, commercial, and recreational. Delavan, Inc., (Delavan) is the only currently identified PRP for OU2.

Operations at the Delavan facility included heat treatment and brazing of metal parts. Prior to heat treatment some metal parts were cleaned using vapor-degreasing solvents, including tetrachloroethene (PCE) and trichloroethene (TCE). Delavan also operated a used-solvent storage tank that was removed approximately 20 years ago. The facility is no longer in operation.

Investigation of OU2 was performed by the PRP with the IDNR as the lead agency. Remediation of OU2 will be performed by the PRP.

2.0 Site History and Enforcement Activities

The Site was first identified in 1993 when a routine water distribution sample collected by the city of West Des Moines was found to contain cis-1,2 dichloroethene (cDCE) at 1.2 micrograms per liter (µg/L). Subsequent sampling of WDMW-13 detected cDCE at significantly higher concentrations than the water distribution sample. The cDCE was found to be entering the water supply from wells WDMW-12 and -13.

The EPA performed a Preliminary Assessment/Site Investigation (PA/SI) under the Superfund Technical Assessment and Response Team program for well WDMW-13 in October 1997. Results of the PA/SI identified two potential groundwater contaminant plumes While contaminants were found in wells WDMW-6 and -7, a distinct groundwater contaminant plume near these two wells was not identified. Soil sampling conducted at five potential source areas could not determine a primary source area. However, due to the variable groundwater flow gradients induced by the water supply wells adjacent to the Site, additional source areas south of the investigated areas along Railroad Avenue were proposed for investigation.

The EPA conducted an ESI in November and December 1999. Samples were collected from areas to confirm the results of the PA/SI and to investigate additional areas. Results from the ESI confirmed there were two source areas and separate groundwater contaminant plumes in the southern and northern portions of the study area. Results also indicated a need for further investigation of OU2 and eastern portion of OU1 to further delineate the plume areas and to locate any other potential source areas.

The EPA held a public meeting on October 24, 2000, in West Des Moines, Iowa, to present a review of the results of the ESI. Questions from the public concerning the Site were answered.

In December 2000, IDNR used direct-push sampling techniques to collect three additional groundwater samples in the eastern portion of OU1. The samples confirmed the results of the ESI. From December 2001 through May 2002, the IDNR collected groundwater samples at 25 locations in OU2 which defined the source and extent of contamination in OU2. In September 2002 the Site was added to the National Priorities List (NPL).

The EPA held a public meeting on August 26, 2003, in West Des Moines, Iowa, to present the first interim response action selected by EPA and IDNR. Construction of the interim response action was completed in November 2004. This action included installation of two aerators at the WDMWW water treatment plant and addresses VOC contaminants entering the WDMWW public water supply, including contaminants associated with OU1 (in accordance with the September 2003 ROD) and OU2.

In March 2004 the RI for OU2 was completed by the PRP. In May 2004 IDNR issued an addendum to the June 2003 baseline risk assessment (RA). The June 2003 RA addressed the entire Site while the addendum updated the RA for OU2 only.

In September 2004 the PRP submitted a Feasibility Study (FS) for OU2. The EPA subsequently approved a second interim response action that involved focused air sparging of groundwater (one of the proposed remedial action alternatives in the FS) in the source area of OU2. The air-sparging system was installed and began operation in December 2005.

In September 2005, the EPA issued a ROD prescribing monitored natural attenuation as the final remedial action for the groundwater contamination within the eastern portion of OU1 that is not captured by the WDMWW.

3.0 Community Participation

The Community Relations Plan, Administrative Record of Activity, Baseline RA, addendum RA, RI Report, FS Report, and supporting documentation were made available to the public for a public comment period which began on July 25, 2006, and was continued until August 24, 2006. The documents are available at the EPA Region VII Office in Kansas City, Kansas, and the West Des Moines Public Library, West Des Moines, Iowa. The notice of the availability of these documents and the time and location of the public meeting were published in the Des Moines Register on July 25, 2006. A fact sheet summarizing the Proposed Plan and preferred alternative was mailed to residents and local administrators on July 21, 2006. A public meeting was conducted during the public comment period at West Des Moines, Iowa, on August 7, 2006, to present the Proposed Plan to the community. The EPA's response to the comments received at the public meeting, as well as written comments received during the comment period, are included in the Responsiveness Summary which is part of this ROD.

4.0 Scope and Role of the Action

This ROD addresses groundwater contaminants of OU2 that are not captured by the WDMWW well field or air-sparging wells. This ROD includes the interim response actions and presents the final remedial actions selected for OU2.

5.0 Site Characteristics

The physical characteristics of the Site, the nature and extent of contamination, and migration of contaminants are discussed in this section. Physical characteristics discussed include topography and surface hydrology, regional hydrogeology and soils, and Site geology and hydrogeology. The location of contaminant sources and distribution of the contaminants of concern (COCs) are discussed.

5.1 Physical Characteristics

The Site is approximately 1,000 acres in size and lies within the flood plain of the Raccoon River and glacial terrain of the Central Lowland Plains. Topography of the area is moderately sloping in the northern reaches and decreases in a southerly direction based on the Site's position relative to the Raccoon River bottoms. The nearest surface water includes the Jordan Creek located approximately 900 feet cross gradient (east), the Raccoon River located approximately 4,500 feet downgradient, and the backwater lakes of Raccoon River Park located approximately 1,850 feet downgradient (south).

Jordan Creek which flows eastward along the north side of the Raccoon River Park and drains much of southeast West Des Moines, also discharges into the Raccoon River. The perennial Raccoon River flows easterly and has an annual mean discharge of about 2,770 cubic feet per second (cfs) where the river flows through the West Des Moines area. Approximately 10 miles downstream of the Site, the Raccoon River discharges into the Des Moines River. The Des Moines River flows to the east and has a mean annual discharge of 6,790 cfs. The Site is situated within the 25-year flood plain of the Raccoon River which last flooded the Site area in July 1993.

The Site is underlain with alluvial sediments consisting of unconsolidated clay, silt, sand, and gravel and lies above the alluvial aquifer of the Raccoon River. The alluvial aquifer consists of stratified sand and gravel deposits that are about 20 feet thick and overlay the shale and coal of the Cherokee Group of the Pennsylvanian System. Depth to bedrock at the Site generally ranges from 40 to 50 feet below the ground surface (bgs).

Groundwater in the alluvial aquifer at OU2 generally flows to the south-southeast toward the Raccoon River. Depth to groundwater ranges from approximately 26 to 32 feet bgs. Groundwater table contour maps were developed from the groundwater elevations (see Figure 3). On the basis of the groundwater contours, it appears groundwater is recharged from upgradient flow and infiltration of precipitation. Groundwater flows toward and discharges into the backwater lakes of Raccoon River Park and Raccoon River south and southeast of OU2.

According to data collected during the RI, the hydraulic gradient in the alluvial aquifer is approximately 0.00036 feet/feet for OU2. The estimated hydraulic conductivity is approximately 200 feet/day (based upon slug test results) at the Delavan facility. It increases with depth and proximity to the WDMWW supply wells to approximately 400 feet/day.

The alluvial aquifer is underlain by the Cherokee Group of the Pennsylvanian system which is approximately 400 feet thick and consists primarily of shale with thin layers of clay, siltstone, sandstone, limestone, and coal. Although the shale units of the Cherokee Group will most likely act as an aquitard (preventing further downward vertical migration of contaminants), sandstone layers within the Cherokee Group provide groundwater to some wells in the southern half of Polk County with yields from 5 to 25 gallons per minute. The thicknesses of these sandstone units are quite variable and the depth of wells drilled into them varies between 75 and 100 feet.

The bedrock aquifer used as a water supply at the Site is the Jordan Aquifer (wells WDMW-1, -3, and -4). The Jordan Aquifer consists of fractured and porous sandstone and dolostone of the Cambrian-Ordovician System which can yield significant amounts of water. The Jordan Aquifer is approximately 2,500 feet bgs. Because of the considerable depth of the Jordan Aquifer, it is extremely unlikely to be affected by contaminants in the alluvial aquifer.

The Site lies within the northeast part of the Forest City Basin bedrock structure. No major faults have been mapped at the surface in the Site vicinity and none are known to be active within the Holocene Epoch.

5.2 Nature and Extent of Contamination

The nature and extent of contamination in the groundwater at the Site was evaluated using data from the ESI and RI sampling events. The monitoring wells and the water supply wells were sampled and analyzed for the presence of VOCs. Data validation efforts qualified results, where necessary, and screened out contaminants identified as potential laboratory contaminants. Because of the frequency of detection and elevated concentrations, the contaminants PCE, TCE, cDCE, and trans-1,2-dichloroethene (tDCE) were determined to be the COCs for OU2. These COCs are known to be toxic to humans and vary in carcinogenic classifications from not classifiable (cDCE) to probable (PCE). The contaminant cDCE was categorized not classifiable based on the lack of human or animal carcinogenicity data.

The highest concentrations in the groundwater were detected within the suspected source area downgradient of the former underground storage tank. These concentrations at the time of the FS were PCE – 7.89 µg/L, TCE – 194 µg/L, cDCE – 33.3 µg/L, and tDCE – 1.8 µg/L. The minimum concentrations in groundwater for all COCs at OU2 were below the Maximum Contaminant Levels (MCLs) and included nondetects. The analytical results and MCLs are summarized in Table 1.

The main COC for OU2 is TCE. The concentration of TCE in groundwater has been contoured in Figure 4 to illustrate the horizontal extent of contaminants in the aquifer. COC concentrations at OU2 can be found on Figure 5, with historical data included in Table 1.

Samples were taken to evaluate the vertical stratification of VOCs at OU2. Significant vertical stratification of contaminants was not indicated.

5.3 Contaminant Migration and Conceptual Site Model

Data has been collected for several years to evaluate conditions. Results of the ESI and RI indicate the primary migration pathway of contaminants at the Site is through groundwater. The conceptual model of the Site is illustrated in Figure 6.

The COCs for OU2 are PCE, TCE, cDCE, and tDCE which are halogenated aliphatic compounds. PCE is widely used in the dry cleaning industry and as a solvent for degreasing. TCE is a common solvent used for degreasing of metals, textile processing, gas purification, and in the manufacturing of pharmaceuticals. The contaminants cDCE and tDCE are occasionally used in the production of solvents; however, their presence in the environment is usually as a result of the degradation of PCE and TCE. The suspected source of the contamination was an underground used-solvent storage tank that was removed approximately 20 years ago by the PRP.

Much of the information about the attenuation processes occurring are presumed to be similar to that of OU1 due to the close proximity of the plumes. The migration of the COCs in groundwater is complex and subject to several physical and chemical processes including biochemical processes and groundwater transport. Initially, the COCs leach vertically downward into groundwater from contaminated subsurface soils in the source area where the contaminants were originally released. As the COCs enter the groundwater, diffusion and advection processes control the migration of the contaminants.

At this Site, advective flow is a dominant migration process and causes contaminants to migrate along with groundwater in the direction of groundwater flow. The groundwater flow direction at OU2 is primarily to the south-southeast toward the Raccoon River. The distribution of the plume also shows evidence of a south-southeasterly groundwater flow trend.

Once in the groundwater, biodegradation and dilution processes reduce the persistence of the contaminants. The COCs typically degrade into daughter compounds through the loss of chlorine atoms. For example, PCE typically degrades to TCE, TCE typically degrades to cDCE and tDCE, cDCE and tDCE typically degrade to vinyl chloride (VC), and VC can degrade to ethene. Finally, ethene (which is not chlorinated) can degrade to carbon dioxide and water. Biodegradation is a preferred natural attenuation process because hydrocarbons are eventually reduced to more stable, less toxic compounds.

Some biodegradation of PCE and TCE is occurring at OU2 as evidenced by the presence of cDCE and tDCE. The extent of the TCE contamination is illustrated in Figure 4 and COCs concentrations can be found on Figure 5 (historical data is included in Table 1).

The COCs may also be adsorbing to the aquifer matrix which will impede contaminant extraction. Studies at other sites contaminated with chlorinated hydrocarbons indicate that two to four times the dissolved concentrations can be expected to be sorbed to the aquifer matrix. Significant amounts of chlorinated solvents can result in accumulations of nondissolved phase contaminants (i.e., dense nonaqueous phase liquids [DNAPL]); however, DNAPL has not been identified at the Site to date.

6.0 Current and Potential Future Site and Resource Uses

The Site is in West Des Moines, Iowa, which is a suburb of Des Moines, Iowa. OU2 lies between Fuller Road and WDMW-19, -20, and -21 and between Grand Avenue and 19th street. Land use in the vicinity of OU2 is primarily light industrial, commercial, and recreational. Future use is anticipated to be similar to current use.

Groundwater in the Site and vicinity is currently used as the primary water source for the city of West Des Moines and local industries. It is anticipated to continue to be used as the city's water source indefinitely. Water supply wells used by the city of West Des Moines have been impacted by OU2 contaminants. However, the addition of the aerators at the West Des Moines treatment plant has allowed the impacted wells to be brought back into useful service.

7.0 Summary of Site Risks

The baseline RAs estimate what risks the Site poses if no action is taken. They provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline RAs for OU2.

7.1 Human Health Risk Assessment

A human health baseline RA for drinking water was prepared for both OU1 and OU2 of the Site. An addendum to the baseline RA using monitoring well data from OU2 was prepared by IDNR in May 2004 to address only the future groundwater ingestion risks for OU2. This summary presents an overview of the RAs prepared for OU2. The complete RAs may be consulted in the Administrative Record for a more detailed evaluation of the Site risks. The human health RAs qualitatively evaluated soils and quantitatively evaluated groundwater at the Site. Contaminants identified in the soil were found to be at acceptable health risk levels and will require no further action. Contaminants identified in the groundwater, however, were found to be at unacceptable health risk concentrations.

7.1.1 Identification of Contaminants of Concern

A RA is an analysis of the potential adverse health effects that may result from human exposure to chemical contaminants present at the Site. The RAs identified several contaminants of potential concern (COPCs) in groundwater. Risk management evaluation of the COPCs relative to natural occurrence, prevalence, and Site history determined the COCs for OU2. The COCs for OU2 are PCE, TCE, cDCE, and tDCE in groundwater. The highest concentrations in the groundwater are detected within the suspected source area downgradient of the former underground storage tank. These concentrations at the time of the FS were PCE – 7.89 µg/L, TCE – 194 µg/L, cDCE – 33.3 µg/L, and tDCE – 1.8 µg/L. The minimum concentrations in groundwater for all COCs at OU2 were below the MCLs and included nondetects.

These VOCs may pose adverse health effects at relatively high concentrations or exposures. Currently water is blended from several WDMWW wells and used for the public water supply. Therefore, for current residents and workers, an average concentration of the COCs at various WDMW wells was used for determining risks. The future risk numbers use the COCs concentration from the most contaminated monitoring well in OU2. This provides a more hypothetical worst-case scenario estimating risk based on future direct exposure from individual wells as opposed to the public water supply. Tables 2, 3, and 4 summarize the COPCs and the Exposure Point Concentrations used in the human health RAs.

7.1.2 Exposure Assessment

The conceptual site model exposure pathways for the Site evaluated in the RAs are presented in Figure 6. Table 5 summarizes all of the scenarios and pathways considered in the risk assessments. As shown, health risks from exposure to groundwater were evaluated for both current (ingestion, dermal contact, and inhalation exposures) and future residents and workers (ingestion exposure). The exposure pathways are also included in Tables 2, 3, and 4.

7.1.3 Toxicity Assessment

The human health RAs evaluated exposures to carcinogenic and noncarcinogenic contaminants at OU2. Tables 6, 7, and 10 provide the noncancer risk information which is relevant to the COCs in the groundwater. All of the COCs have toxicity data indicating their potential for adverse noncarcinogenic health effects in humans and have oral reference doses (RfD) ranging from 3×10^{-4} to 2×10^{-2} mg/kg-day. TCE and PCE also have inhalation reference concentrations of 4×10^{-2} and 4×10^{-1} mg/m^3 respectively. The target organs for the COCs include the blood, liver, kidneys, and a fetus. The COCs can also target the endocrine and central nervous systems.

Tables 8, 9, and 10 provide the carcinogenic risk information that is relevant to the COCs in the groundwater at OU2. At the time of the RAs slope factors for cDCE and tDCE are not available for either oral or inhalation exposure. The slope factors for inhalation and oral exposure routes for PCE and TCE range from 6×10^{-3} to 4×10^{-1} (mg/kg-day)$^{-1}$. An adjustment factor was applied, as appropriate, dependent upon how the chemical is absorbed via the specified route.

Sources for the carcinogenic and noncarcinogenic toxicity data include the following: the Integrated Risk Information System, Health Effects Assessment Summary Tables, and National Center for Environmental Assessment.

7.1.4 Risk Characterization

Carcinogens risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

where: Risk = a unitless probability (e.g., 2×10^{-5}) of an individual's developing cancer,
CDI = chronic daily intake averaged over 70 years [milligrams per kilogram-day (mg/kg-day)],
SF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$.

These risks are probabilities that are usually expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred as an *excess lifetime cancer risk* because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. The EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with an RfD derived for a similar exposure period. An RfD represents a level an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). A HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from that chemical are unlikely.

The Hazard Index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. A HI less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. A HI greater than 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:
Noncancer HQ = CDI/RfD;
where: CDI = Chronic daily intake,
RfD = Reference dose.
The CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short term).

As indicated in Table 11, the cancer and hazard levels indicate there are currently no significant risks associated with OU2 contaminants. The excess carcinogenic risks to current lifetime residents (adult and child) were calculated to be 6 x 10^{-6} to 2 x 10^{-5} and excess carcinogenic risk to current industrial workers was calculated to range from 1 x 10^{-6} to 3 x 10^{-6}. The noncarcinogenic risk (expressed as HQs) to current lifetime resident adults, current lifetime resident children, and industrial workers was calculated to be 0.5, 1, and 0.2, respectively.

However, unacceptable cancer and noncarcinogenic risks resulted for the hypothetical future resident and industrial worker. The excess carcinogenic risk to future lifetime residents (adult and child) was calculated to range from 7 x 10^{-5} to 1 x 10^{-3} and excess carcinogenic risks to future industrial workers were calculated to range from 1 x 10^{-5} to 3 x 10^{-4}. The maximum noncarcinogenic risks to future lifetime resident adults, future lifetime resident children, and industrial workers were calculated to be 18, 41, and 6 respectively. The carcinogenic and noncarcinogenic risks are associated with the ingestion of groundwater contaminated with TCE.

Table 12 presents risk information for COPCs and media/exposure points that could hypothetically trigger the need for remedial action. Risk management evaluation of the COPCs relative to natural occurrence, prevalence, and Site history determined the COCs for OU2. The COCs at OU2 are PCE, TCE, cDCE, and tDCE in groundwater.

7.2 Ecological Risk Assessment

The Screening-Level Ecological risk assessment evaluated analytical data as they relate to ecological risks at the Site. The risk assessment identified several preliminary contaminants of potential ecological concern (PCOPECs). Risk management evaluation of the PCOPECs relative to natural occurrence, prevalence, current and future Site use, and Site history determined current and future ecological risks posed by Site contaminants are at acceptable levels.

7.3 Risk Assessment Summary and Conclusion

Though the cancer risks and hazard levels indicate there are no significant risks associated with current residents and workers at OU2, there are potential concerns for future resident and worker exposure should a contaminated well be used for drinking water. The excess carcinogenic risk to future lifetime residents (adult and child) was calculated to range from 7 x 10^{-5} to 1 x 10^{-3} and excess carcinogenic risks to future industrial workers were calculated to range from 1 x 10^{-5} to 3 x 10^{-4} (Table 11). The maximum noncarcinogenic risks to future lifetime resident adults, future lifetime resident children, and industrial workers were calculated to be 18, 41, and 6 respectively (Table 11).
The remedial action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances from OU2. However, no current unacceptable risks exist since no one is drinking untreated water that may contain the COCs.

8.0 Remedial Action Objectives

The Comprehensive Environmental Response, Compensation, and Liability Act, as amended, (CERCLA) requires selection of remedial actions which ensure protection of human health and the environment, attain applicable or relevant and appropriate requirements (ARARs), are cost effective, use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfy the preference for treatment that reduces the toxicity, mobility, or volume of contaminants or provide an explanation as to why they do not. To satisfy CERCLA requirements, a remedial action objective (RAO) was developed for OU2. General response actions were then developed to attain the RAO.

The RAO developed for the contaminated groundwater at OU2 is identified below.

> Prevent ingestion of groundwater having concentrations of OU2 COCs in excess of current regulatory drinking water standards. The current regulatory drinking water standards for the COCs are the MCLs. The MCLs are the maximum permissible levels established by the Safe Drinking Water Act [40 Code of Federal Regulations (CFR) 141] for a contaminant in water that is delivered to any user of a public water system.

The primary focus of the remedial action is to address remediation of the contaminated groundwater which is the primary risk posed by OU2.

9.0 Description of Alternatives

CERCLA requires the selected alternative be protective of human health and the environment, be cost effective, comply with other environmental laws, and use permanent solutions, alternative treatment technologies, and resource recovery alternatives to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances.

The FS for OU2 evaluated several remedial alternatives for addressing the contamination associated with OU2. One of the alternatives (the air-sparging wells) was implemented as an interim response action. The proposed plan evaluated two other alternatives identified in the FS, and the *No Action* alternative required by law, using the nine criteria that appear in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

For the purpose of analyzing and comparing the remedial alternatives, the PRP and IDNR estimated costs of the alternatives by making certain assumptions such as estimating the remediation time for pumping and treating groundwater. The EPA Superfund policy is to try to estimate costs with a +50/-30 percent accuracy.

The present worth of each alternative was calculated assuming a five percent discount rate (as agreed by the PRP, IDNR, and EPA) for up to 20 years. The present worth is a summary measure of cost that (for comparison purposes) turns a stream of payments or costs over a future period of years into the equivalent of a single lump sum in the present. The cost estimates discussed above are conceptual with an estimated +50 percent to -30 percent level of accuracy. The alternatives from the FS Report and Proposed Plan are described in the remainder of Section 9. Section 10 compares the alternatives. Section 12 discusses the selected alternative. Section 12 also discusses several additional measures that will be taken as part of the selected remedy.

The two interim response actions are common to all alternatives and will be incorporated into the selected remedy. The first interim response action addressed the WDMWW well field area for both OU1 and OU2 and has been in operation since construction was completed in November 2004. This action included installation of two new aerators at the WDMWW water treatment plant.

The purpose of the second interim response action involving air sparging is to treat the groundwater contamination at the suspected source area of OU2, thereby preventing off-site migration of contaminants above MCLs. The RAO for the source area is predicted to be achieved in two years with air sparging. Please note the cost estimates presented with the alternatives are in addition to the costs for the ongoing interim response actions.

All of the alternatives except the no action alternative also include institutional controls and public education as common elements. This includes the following:

1. Continuing implementation of Polk County and IDNR well permitting requirements to limit use of groundwater at OU2. These permitting requirements consist of an existing ordinance by Polk County, Iowa, prohibiting the installation of new nonpublic wells if public water is reasonably available and the restriction of new public wells in areas of contamination provided in IDNR regulations (subparagraph 567 Iowa Administrative Code (IAC) 43.3(7)"b"(5).

2. Implementation of other well permitting requirements or groundwater restrictions as deemed necessary to limit use of groundwater at OU2. The permitting requirements could consist of a more stringent ordinance passed by the city of West Des Moines, Iowa, prohibiting the installation of new wells if city water is available. If a local permit ordinance could not be passed, a protected water source designation at the state level could be sought. In a protected water source area new well installation would be restricted.

3. Informing local officials of well drilling restrictions and informing citizens of the potential health hazards associated with exposure to contaminated ground water through various public education efforts. Public education could be implemented through informational meetings and fact sheets.

9.1 Alternative 1: No Action

Estimated Capital Cost:	$0
Estimated Annual Operation and Maintenance (O&M) Cost:	$0
Estimated Present-Worth Cost:	$0
Estimated Construction Timeframe:	0 months
Estimated Time to Achieve RAOs:	Indeterminate

The NCP requires the EPA consider a no-further-action alternative as a baseline against which other remedial alternatives can be compared. Under this alternative, no further action would be taken to monitor, control, remediate, or prevent exposure to groundwater contamination. Alternative 1 would not meet the RAO because it would not prevent exposure to groundwater contamination above MCLs. Specifically this alternative leaves no mechanism to evaluate or demonstrate the reduction in the toxicity, mobility, or volume of contaminants through the natural attenuation processes and leaves the possibility for the plume to migrate unknowingly to new receptors.

9.2 Alternative 2: Monitored Natural Attenuation

Estimated Capital Cost:	$20,200
Estimated Annual O&M Costs:	$36,000
Estimated Present-Worth Costs:	$506,000
Estimated Construction Timeframe:	0 months
Estimate Range of Time to Achieve RAO:	20 years

Alternative 2 would rely on the aquifer's ability to lower contaminant concentrations through monitored natural attenuation (MNA) processes. MNA processes refers to naturally occurring processes in the environment that act to reduce the mass, toxicity, mobility, volume, or contaminant concentrations in various media. These in-situ processes include dilution, dispersion, volatilization, adsorption, biodegradation, and chemical or biological stabilization or destruction of contaminants.

This alternative includes institutional controls and public education to prevent future exposure to groundwater with contaminants above MCLs.

This alternative would also include groundwater monitoring to evaluate the effectiveness of the natural attenuation processes. A detailed sampling and quality assurance plan would be written before the groundwater monitoring activities begin. The sampling and quality assurance plan would include sample locations, sampling frequency, sampling procedures, sample analysis methods, and sample documentation procedures. The existing monitoring well network has been deemed adequate.

It was assumed the groundwater monitoring would consist of semiannual sampling the 13 existing monitoring wells and wells WDMW-19 and WDMW-21. The frequency of the monitoring could be reevaluated and modified after the five-year reviews or after review of monitoring data by the EPA and IDNR. The groundwater samples would be analyzed for VOCs and other geochemical data necessary to ensure effective natural attenuation processes are still occurring. The estimated time frame required to attain cleanup levels with Alternative 2 is 20 years, with an additional three years of confirmatory groundwater monitoring after achieving the RAO.

The results of the sample analysis would be used to confirm the rate and direction of groundwater contaminant migration. If the monitoring results indicate the plume is migrating toward new receptors, further response actions would be initiated.

9.3 Alternative 3: Focused Pump and Treat

Estimated Capital Cost:	$405,000
Estimated Annual O&M Costs:	$190,000
Estimated Present-Worth Costs:	$2,422,000
Estimated Construction Timeframe:	9 months
Estimated Time to Achieve RAOs:	15 years

Alternative 3 would include focused groundwater pump and treat in the area of highest groundwater contamination. The pump and treat system would consist of five groundwater recovery wells, on-site treatment via carbon adsorption, and discharge of treated water to an outfall (probably a nearby stream or storm sewer). The estimated maximum process flow rate is 50 gallons per minute.

Treatment would involve passing the pumped groundwater through a bed of activated carbon. Organic contaminants (such as the COCs) physically adsorb to the carbon. Eventually the carbon reaches its adsorptive capacity and must be replaced. Spent carbon would be taken off-site for regeneration or disposal. No air emissions would result from this process.

Similar to Alternative 2, this alternative would also include groundwater monitoring. For cost estimating purposes in this alternative it was assumed monitoring would continue for three years after achievement of the RAO. The monitoring results would be used to confirm the rate and direction of groundwater contaminant migration. If the monitoring results indicate the plume is migrating toward new receptors further response actions would be initiated.

10.0 Comparative Analysis of Alternatives

Nine criteria are used to evaluate the different alternatives individually and against each other in order to select a remedy. The nine evaluation criteria are: (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume of contaminants through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state/support agency acceptance; and (9) community acceptance. This section of the ROD profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration. The nine evaluation criteria are discussed below and are summarized in Table 13.

10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

As a result of the ongoing interim response actions, all three alternatives provide short-term protection of human health and the environment. With the use of institutional controls and public education, Alternatives 2 and 3 would provide the highest overall protection by eliminating or minimizing the chance of a receptor being exposed to the contaminated groundwater at OU2.

Alternatives 2 and 3 also provide the benefit of monitoring changes in the plume so future actions can be taken if deemed necessary. Alternative 3 may provide slightly more protection by collecting and treating the extracted groundwater before contaminants have the opportunity to migrate.

10.2 Compliance with ARARs

Compliance with ARARs evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to OU2 or whether a waiver is justified.

Through natural attenuation and the interim response actions, all three alternatives are capable of achieving chemical-specific ARARS (groundwater cleanup criteria) in essentially the same time frame. However, since groundwater monitoring would not be conducted under Alternative 1, there would be no mechanism to evaluate or demonstrate that the ARARs have been satisfied.

Action-specific ARARs would only apply to Alternative 3 and include wastewater discharge and waste disposal (for spent activated carbon) regulations. For on-site cleanup activities (under Section 121(e)(1) of CERCLA) EPA is not required to obtain federal, state, or local permits for actions conducted on-site [including National Pollutant Discharge Elimination System (NPDES) permits], complying only with the substantive (nonadministrative) requirements of the identified federal and state laws. However, for cleanup activities that will occur off-site, both the substantive as well as the administrative requirements of such laws will apply to cleanup activities. Alternative 3 would be able to comply with these action-specific ARARs. No location-specific ARARs were identified for any alternative.

10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

Natural attenuation of COCs at OU2 coupled with the current interim response actions is expected to be effective and permanent for all three alternatives. However, since groundwater monitoring would not be conducted under Alternative 1, there would be no mechanism to evaluate or demonstrate the long-term effectiveness and permanence of the natural attenuation processes. Alternative 3 may provide the best long-term effectiveness and permanence by collecting and treating the extracted groundwater in the shortest amount of time; therefore, reducing the likelihood that contaminants have the opportunity to migrate.

10.4 Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment

Reduction of toxicity, mobility, or volume of contaminants through treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

All three Alternatives would be effective in reducing the toxicity and volume of contaminants at the completion of the Remedial Actions. Under Alternatives 1 and 2, reduction of the toxicity of most of the COCs will occur in the last phases of the natural attenuation process. All COCs would eventually attenuate and the meet RAO. By capturing the contaminated groundwater, Alternative 3 would reduce the mobility of contaminants more so than Alternatives 1 and 2. Because groundwater monitoring would not be conducted under Alternative 1, there would be no mechanism to evaluate or demonstrate the reduction in the toxicity, mobility, or volume of contaminants through natural attenuation processes.

10.5 Short-Term Effectiveness

Short-term effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

Since there are no anticipated construction activities with Alternatives 1 and 2 there would be no increase in short-term risks to workers, residents, or the environment. However, under Alternative 1 there would be a continued risk to the community because contaminants above MCLs would remain on-site, unmanaged, and unmonitored. Alternative 3 has the greatest short-term risk (although still moderately low) during construction of the new on-site treatment plant, associated pipelines, and groundwater recovery wells.

10.6 Implementability

Implementability considers the technical and administrative feasibility of implementing the alternative such as the relative availability of goods and services.

Alternatives 1 and 2 are the easiest alternatives to implement because no construction is anticipated. Alternative 3 would be the most difficult to implement, requiring construction of a new on-site treatment plant, installation of collection and discharge piping, and installation of recovery wells as well as more extensive O&M.

10.7 Cost

Cost includes estimated capital and O&M costs as well as present-worth costs. The present-worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 percent to -30 percent.

Cost estimates were prepared for each alternative and do not include common elements such as the ongoing interim response actions, public education, five-year reviews, or decommissioning/closing of related equipment and structures. These estimates are approximate and made without detailed engineering data. The actual cost of the project would depend on the final scope of the remedial action and other unknowns. The present worth of each alternative was calculated for all alternatives assuming a five percent discount rate (as agreed by the PRP, state, and EPA) for up to 20 years. There would be no additional costs with Alternative 1. The total present-worth cost of Alternative 2 is $506,000 and Alternative 3 is $2,422,000.

10.8 State/Support Agency Acceptance

State/support agency acceptance considers whether the support agency—the EPA in this case—agrees with the lead agency's analyses and recommendations on the RI, FS, and Proposed Plan.

The EPA supports the preferred alternative, Alternative 2 (Monitored Natural Attenuation) proposed by the IDNR.

10.9 Community Acceptance

Community acceptance considers whether the local community agrees with the EPA and IDNR's analyses and preferred alternative. Comments received on the Proposed Plan are important indicators of community acceptance.

During the public comment period, the EPA did not receive comments pertaining to the OU2 alternatives. However, EPA has had discussions with the city and others who expressed their support for Alternative 2 (Monitored Natural Attenuation) as proposed by the IDNR and the EPA.

11.0 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site whenever practicable [NCP §300.430(a)(1)(ii)(A)]. The *principal threat concept* is applied to the characterization of *source materials* at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. Generally contaminated groundwater is not considered to be a source material; however, nonaqueous phase liquids (NAPLs) in groundwater may be viewed as a source material. Identifying principle threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, nonprincipal threat wastes are those source materials that generally can be reliably contained and would present only a low risk in the event of exposure.

The original source materials for the VOCs in OU2 came from an underground storage tank and the surrounding contaminated soil. These principal threat wastes were removed by the PRP approximately 20 years ago.

12.0 Selected Remedy

This section expands upon the details of the selected remedy presented in the Description of Alternatives Section (Section 9) of this ROD.

12.1 Summary of the Rationale for the Selected Remedy

The selected remedy for OU2 is Alternative 2 (Monitored Natural Attenuation) to be performed simultaneously with the previous interim actions that included expansion of the stripping capacity at the West Des Moines drinking water plant and installation of air-sparging wells in the area of largest contaminant concentration. These previously implemented interim response actions were intended to protect the West Des Moines water supply from contamination and treat the area with the largest concentration, leaving the final remedy to address only the remaining contaminants.

This alternative will provide the best balance of trade-offs among alternatives with respect to the evaluating criteria. The EPA and IDNR believe Alternative 2, in conjunction with the previous interim actions, will be protective of human health and the environment, will comply with ARARs, will be cost effective, and will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The main factors influencing EPA and IDNR in their selection of Alternative 2 as the remedy include:

- Institutional controls and public education will eliminate or minimize the chance of a receptor being exposed to the contaminated groundwater at OU2.
- Data indicates that significant amounts of a source material or NAPLs no longer remain at OU2; hence, there is no evidence of principal threat wastes at OU2.
- Monitoring of OU2 is warranted because of the levels of COCs detected in the groundwater.
- Current monitoring data at OU2 indicate natural attenuation is actively occurring.

12.2 Description of Selected Remedy

The selected remedy will rely on the aquifer's ability to lower contaminant concentrations through MNA processes. The MNA processes include dilution as noncontaminated water enters the groundwater flow path, adsorption of contaminants to aquifer materials, and biodegradation of contaminants. The remedy will include continuation of the interim response actions, institutional controls, and public education to minimize potential health risks associated with groundwater contaminants still undergoing attenuation and groundwater monitoring. The estimated time frame required to attain cleanup levels is 20 years, with an additional three years of confirmatory groundwater monitoring after achieving the RAO.

The continued implementation of Polk County and IDNR well permitting requirements to limit use of groundwater at OU2 will be included in the selected remedy. The Polk County permitting requirement consists of an existing ordinance prohibiting the installation of new nonpublic wells if public water is reasonably available. The IDNR permitting requirement includes the restriction of new public wells in areas of contamination provided in IDNR regulations [subparagraph 567 IAC 43.3(7)"b"(5)].

Implementation of other well permitting requirements or groundwater restrictions will be included as deemed necessary to limit use of groundwater at OU2. The permitting requirements could consist of a more stringent ordinance passed by the city of West Des Moines, Iowa, prohibiting the installation of new wells if city water is available. If a local permit ordinance could not be passed, a protected water-source designation at the state level could be sought. In a protected water-source area new well installation would be restricted.

Public education will be used to inform local officials of well drilling restrictions and to inform citizens of the potential health hazards associated with exposure to contaminated ground water. Public education will be primarily implemented through fact sheets and publications in the local newspaper, though informational meetings may be scheduled as necessary.

Groundwater monitoring will be included to evaluate the effectiveness of the natural attenuation processes. A detailed sampling and quality assurance plan will be written before the groundwater monitoring activities begin. The sampling and quality assurance plan will include sample locations, sampling frequency, sampling procedures, sample analysis methods, and sample documentation procedures.

Groundwater monitoring will consist of semiannual sampling of 13 existing monitoring wells and wells WDMW-19 and WDMW-21. The frequency of the monitoring may be reevaluated and modified after the five-year reviews or after review of monitoring data by the EPA and IDNR. The groundwater samples will be analyzed for VOCs and possibly other aquifer geochemical data (i.e., electron acceptors, electron donors, and dechlorination byproducts such as ferrous iron and methane) needed to ensure effective natural attenuation processes are still occurring.

The results of the sample analysis will be used to confirm the rate and direction of groundwater contaminant migration. If the monitoring results indicate that the plume is migrating toward new receptors, further response actions will be initiated.

12.3 Summary of Estimated Costs

The detailed cost summary of the capital, O&M, and institutional control costs associated with the implementation of the groundwater monitoring and reporting portion of the selected remedy, as discussed in the Alternative 2 section of this ROD (Section 9.2), is presented in Tables 14 and 15. Table 16 includes cost estimates for the activities in addition to Alternative 2.

The capital costs for groundwater monitoring and reporting include both direct and indirect capital costs. The direct capital costs include initial/baseline monitoring efforts. The indirect costs include engineering/project management and permitting/institutional controls. The total capital cost is estimated to be $20,200.

The annual O&M costs for groundwater monitoring and reporting are estimated to be $36,000. The total present worth for 23 years of O&M costs for groundwater monitoring and reporting is $486,000. The total present worth of the capital and O&M costs for groundwater monitoring and reporting is estimated to be $506,000.

Other costs associated with the selected final remedy for OU2 includes those of the air-sparging wells O&M, five-year reviews, public education, and decommissioning/closure of air-sparging/monitoring wells and related equipment/structures. Since there are no anticipated additional costs for the aerators from those described in the 2003 ROD for OU1, their cost estimates are not included as part of this ROD. The O&M costs for the air-sparging wells include the electricity, labor, and materials needed to keep the system running. The annual O&M costs for the air-sparging wells are estimated to be $42,000.

Since contaminants are being left on-site, five-year reviews will need to be conducted. With an estimated time frame of 20 years, there would be four reviews with an estimated cost of $50,500 each. Public education efforts will be completed as part of each five-year review. The efforts will include a publication in a local newspaper and fact sheets. Cost estimates include the time to prepare these documents along with the mailing costs and costs to publish the article. The estimated cost for public education is $4,000 per five-year event.

The final additional costs are those associated with appropriate decommissioning and closure of the monitoring wells, air-sparging wells, and other related equipment and structures (Table 16). The estimated cost for abandonment of the wells and related equipment and structures is $40,900.

Therefore, the estimated present worth of the groundwater monitoring and reporting portion of the selected remedy as presented in Alternative 2 is $506,000 with additional costs for other activities associated with the remedy. The information in the cost estimates is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the selected remedy. Changes may be documented in the form of a memorandum in the Administrative Record, an Explanation of Significant Difference, or a ROD amendment.

12.4 Expected Outcomes of the Selected Remedy

The aquifer is expected to be available as a drinking water resource as a result of successful completion of the remedy. The selected remedy will require an extensive period of time (estimated at 20 years) to attain final cleanup levels for the aquifer.

Final cleanup levels were established for groundwater at OU2 based on the MCLs established under the Safe Drinking Water Act. The final cleanup levels for groundwater are presented in Table 17. The cleanup level for groundwater will restore the groundwater to drinking water quality with respect to VOC contamination.

13.0 Statutory Determinations

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedial action will protect human health and the environment. Dilution and biodegradation processes at OU2 will eliminate the groundwater pathways through which contaminants pose risks. Restricting use of groundwater at OU2 through institutional controls and public education will prevent inadvertent use of groundwater contaminated above cleanup levels.

13.2 Compliance with ARARs

Section 121(d)(2) of CERCLA, 42 USC §9621(d)(2), requires that cleanup actions conducted under CERCLA achieve a degree or level of cleanup which, at a minimum, attains—

> "...any standard, requirement, criteria or limitation under any Federal environmental law...or any promulgated standard, requirement, criteria, or limitation under a State environmental or facility sitting law that is more stringent than any Federal standard...[which] is legally applicable to the hazardous substance or pollutant or contaminant concerned or is relevant and appropriate under the circumstances of the release or threatened release of such hazardous substance or pollutant or contaminant...."

The identified standards, requirements, criteria, or limitations thus adopted from other environmental laws which govern on-site cleanup activities at OU2 are referred to as ARARs.

For on-site cleanup activities under Section 121(e)(1) of CERCLA, the EPA is not required to obtain federal, state, or local permits for actions conducted on-site (including NPDES permits). The EPA must comply only with the substantive (nonadministrative) requirements of the identified federal and state laws. However, for cleanup activities that will occur off-site, both the substantive as well as the administrative requirements of such laws will apply to cleanup activities.

This section identifies the ARARs that will apply to the remedy selected for OU2. (The many laws and regulations that apply to off-site cleanup or disposal activities are not ARARs and are not enumerated here.)

- National Primary Drinking Water Standard Safe Drinking Water Act (40 CFR Part 141) and Iowa Water Sources (IAC 567 Chapter 41, 133, and 137): Establishes MCLs for a number of common organic and inorganic contaminants including the COCs for OU2.

These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater aquifers potentially used for drinking water.

- Iowa Protected Water Sources-Purposes-Designation Procedures-Information in Withdrawal Applications-Limitations-List of Protected Sources (IAC 567 Chapter 53): Provides for designating a protected water source.

In addition, all remedial activities for OU2 would need to comply with Occupational Safety and Health Administration requirements.

13.3 Cost Effectiveness

The selected remedial action is cost effective, providing overall effectiveness proportional to its costs. The selected remedy will be effective in the long term providing a significant and permanent reduction of the toxicity, mobility, and volume of contaminated groundwater contaminants.

13.4 Utilization of Permanent Solutions and Innovative Treatment Technologies to the Maximum Extent Practicable

The IDNR has determined—and the EPA agrees with IDNR's determination—the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner for OU2. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and IDNR have determined this selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and considering supporting agency and community acceptance.

The selected remedy treats the primary threats posed by VOC-contaminated groundwater, achieving VOC reduction through attenuation processes and the interim response actions. The selected remedy will permanently and significantly reduce the toxicity, mobility, and volume of the COCs. The most significant difference among the proposed groundwater alternatives that met overall protection and ARARs was with regard to the cost and implementability.

13.5 Preference for Treatment which Reduces Toxicity, Mobility, or Volume

The combination of the selected alternative along with the interim response actions satisfies the statutory preference for treatment as a principal element. The toxicity, mobility, and volume of the COCs will be permanently and significantly reduced through natural attenuation processes and the interim response actions.

13.6 Five-Year Review Requirements

Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(C) requires a five-year review if the remedial action results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. Since contaminants are being left on-site, five-year reviews will need to be conducted.

14.0 Documentation of Significant Changes

The selected remedy has not been significantly changed from the preferred alternative presented in the Proposed Plan.

Responsiveness Summary to Public Comments

Southern Plume – Operable Unit 2
Railroad Avenue Groundwater Contamination Site
West Des Moines, Iowa

During the public comment period from July 25 – August 24, 2006, no written comments were received. Below is a summary of questions asked at the public meeting held on August 7, 2006.

Comment 1: Two commenters expressed concern about an existing monitoring station on the corner of 11th and Railroad Avenue and whether it could be removed. They were also concerned about wells on their property that have not been checked in a long time and are in disrepair.

Response 1: As was noted at the meeting, the monitoring station and wells are not for the EPA Railroad Avenue project. An IDNR representative at the meeting agreed to check with the state's leaking underground storage tank program and see if the station could be removed and wells appropriately abandoned. The IDNR representative relayed the information to the underground storage tank people at IDNR and they are working on the issue.

Abbreviations and Acronyms

ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
cDCE	cis-1,2-dichloroethene
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
COCs	Contaminant of Concern
COPC	Contaminant of Potential Concern
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	Environmental Protection Agency
ESI	Expanded Site Inspection
FS	Feasibility Study
ft	Feet
HI	Hazard Index
HQ	Hazard Quotient
IAC	Iowa Administrative Code
IDNR	Iowa Department of Natural Resources
MCL	Maximum Contaminant Level
µg/L	Micrograms per Liter
mg/kg	Milligram per Kilogram
mg/m^3	Milligram per Meter Cubed
MNA	Monitored Natural Attenuation
NAPL	Non-Aqueous Phase Liquid
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PA/SI	Preliminary Assessment and Site Investigation
PCE	Tetrachloroethene
PCOPEC	Preliminary Contaminant of Potential Ecological Concern
PRP	Potentially Responsible Party
RA	Risk Assessment
RAO	Remedial Action Objective
RfD	Oral Reference Dose
RI	Remedial Investigation
ROD	Record of Decision
tDCE	trans-1,2-dichloroethene
TCE	Trichloroethene
VC	Vinyl Chloride
VOC	Volatile Organic Compound
WDMW	West Des Moines Well
WDMWW	West Des Moines Water Works